

CARBIDE AND CARBON CHEMICALS COMPANY

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Official: Malcolm Theisen, Conservator  
(Name/Title)

February 25, 1954

Date: 7-18-96

United States Atomic Energy Commission  
Post Office Box E  
Oak Ridge, Tennessee

DECLASSIFICATION AUTHORIZED gm  
GABRIEL MARCIANTE, ORO CLASSIFICATION OFFICER  
NAME (ADD) - ORGANIZATION  
4/9/96  
DATE

Subject: Explosions in Conversion  
Reactors (U)

Attention: Mr. R. C. Armstrong

Gentlemen:

The investigation of the conversion reactor failures, reported to you verbally in October, 1953, has been completed. One of these failures occurred on September 23, and the other one on September 28, 1953. Since both were of the same nature, this report covers the two cases.

The reactors were being started up according to the operating procedure in effect at that time, i.e., the batches each containing 500 grams of uranium were loaded into the reactors and the power turned on with the temperature control instruments set to bring the reactors up to operating temperature. Nitrogen gas was turned on to flush the air out of the units. After flushing with nitrogen for a period of the hydrogen gas was turned on. The reactor temperatures were approximately with the exhaust gas thermocouple readings approximately when the explosions occurred. It is assumed that the hydrogen built up an explosive mixture which ignited. This apparently was caused by plugging of the exhaust lines which prevented a thorough flush of the reactors with nitrogen and, consequently, caused the explosive mixture of hydrogen and air to ignite.

The explosions resulting from the plugged exhaust gas lines caused the reactor linings to split at the seams from one end to the other and some product material was blown onto the floor and on adjacent operating equipment. All of the equipment involved in the spills was thoroughly cleaned and material accountability established in each case. Since the uranium content of each K-25 product cylinder is determined by analysis (after solutioning) and the exact amount in each process batch is not known, the estimation of loss must be based upon the entire content of the cylinders of which the batches involved were a part. The results are presented below:

DECLASSIFICATION RECOMMENDED  
MALCOLM THEISEN, EASI  
Name (ADC) - Organization

4-09-96

Date 4/9/96 Reviewing g. Marcante ORO  
Official: (Name/Title)  
Date: 4/9/96

ORO 41052

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First Explosion

Uranium Content of Cylinder by Analysis		5540.27 gms
Uranium as $UF_4$ from Processed Cylinder	5271.20 gms	
Uranium as Nitrate Solution from Salvage of the Spill	249.40 gms	
Normal Amount of Uranium Retained in the Filtrates	$\frac{25.00}{5545.60}$ gms	
		$\frac{5545.60}{+4.33}$ gms

Second Explosion

Uranium Content of Cylinder by Analysis		5161.23 gms
Uranium as $UF_4$ from Processed Cylinder	4880.46 gms	
Uranium as Nitrate Solution from Salvage of the Spill	221.44 gms	
*Normal Amount of Uranium Retained in the Filtrates	$\frac{25.00}{5126.90}$ gms	
		$\frac{5126.90}{-34.33}$ gms

\* This is an unmeasured amount since it is not present procedure to sample the filtrate from each cylinder separately; however, past experience indicates that the filtrates contain approximately 25 grams.

You will observe that in the first case there is a gain of 4.33 grams and in the second, a loss of 34.33 grams; therefore, since the losses fall within the limits set up by the Uranium Control Department, it is felt that there was no appreciable loss in either case.

In order to eliminate the possibility of another explosion occurring from the same cause, an operating procedure change has been made and a closer check is being maintained of operating conditions during the start-up period.

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The procedure steps are as follows:

1. The hydrogen valve is checked to make sure it is closed at the start of operation.
2. The nitrogen is turned off and the hydrogen turned on when the temperature of the exhaust line reaches
3. If the exhaust temperature does not rise to before the furnace temperature reaches the foreman will personally check the unit for gas flow and in this case the hydrogen will be turned on only by the foreman.

This procedure should eliminate future difficulty since the exhaust gas line thermocouple will record a resultant increase in temperature of the exhaust gas if the line is open, and similarly the temperature will not rise to  $[150^{\circ}\text{C}]$  if the line is plugged and there is no flow from the heated reactor. In the event this condition is noted, appropriate actions will be taken to prevent difficulty.

Yours very truly,

CARBIDE AND CARBON CHEMICALS COMPANY

  
J. P. Murray  
Y-12 Plant Superintendent

JMH:met

Distribution:

Copies 1 - 2: R. C. Armstrong  
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